

## CLAIMS

What is claimed is:

1. An apparatus for adaptive brightness control, comprising:
  - a probability density function (PDF) calculation unit calculating a PDF based on a distribution of pixel values of pixels of an input image signal;
  - a compensation value calculation unit calculating an average value of the pixel values of the respective pixels, and calculating a function having a predetermined slope according to a range of an average brightness value; and
  - a pixel value compensation unit re-establishing the distribution of the pixel values based on the calculated function.
2. The apparatus as claimed in claim 1, wherein the pixel value compensation unit includes:
  - a PDF compensation unit comparing values of the calculated function with PDF values obtained by the PDF calculation unit;
  - a cumulative distribution function (CDF) generation unit calculating a cumulative distribution function for the PDF re-established by the pixel value compensation unit; and
  - a mapping unit re-establishing pixel values of the input image signal based on the cumulative distribution function.
3. The apparatus as claimed in claim 2, wherein the CDF generation unit calculates a CDF for the PDF based on the following formula:

$$CDF(K) = \sum_{t=0}^t PDF(t)$$

wherein CDF(K) denotes a cumulative distribution function, PDF(t) is a probability density function, and t is a maximum pixel value displayable when the image signal is displayed on a screen.

4. The apparatus as claimed in claim 3, further comprising a cumulative distribution function (CDF) compensation unit provided between the CDF generation unit and the mapping unit, to convert outputs of the CDF generation unit based on the following formula:

$$CDF'(K) = CDF(K) - \frac{CDF(N-1)}{N-1}K + F(K)$$

wherein  $CDF'(K)$  denotes a compensated cumulative distribution function,  $CDF(K)$  is a cumulative distribution function before compensation,  $F(K)=(\text{the total number of pixels of an image signal}/(N-1))K$ ,  $N-1$  is a maximum pixel value, and  $CDF(N-1)$  is a value of the cumulative distribution function at the maximum pixel value.

5. The apparatus as claimed in claim 1, wherein the compensation value calculation unit includes:

- an average value calculation unit calculating an average pixel value;
- an average value range calculation unit setting a range of the calculated average pixel value; and
- a function value output unit outputting to the pixel value compensation unit a function corresponding to the range of the calculated average value.

6. The apparatus as claimed in claim 1, wherein the function is one among a monotonic increasing function, a monotonic decreasing function, and a constant function.

7. The apparatus as claimed in claim 1, wherein the pixel value is one among the brightness value, a grayscale value of three primary colors R, G, B and a grayscale value of color difference signals Y, Cb, Cr.

8. An adaptive brightness control method, comprising:

- calculating a probability density function (PDF) based on a distribution of pixel values of respective pixels of an input image signal;
- calculating an average pixel value of the detected pixel values, and calculating a function having a predetermined slope according to a range of the average pixel value, and
- re-establishing the distribution of the pixel values based on the calculated function.

9. The adaptive brightness control method as claimed in claim 8, wherein the re-establishing the brightness value distribution includes:

comparing values of the calculated function with values of the calculated PDF, and increasing and decreasing a part of the PDF values;

calculating a cumulative distribution function for the PDF which has the increased and decreased PDF values; and

re-establishing pixel values of the input image signal based on the cumulative distribution function.

10. The adaptive brightness control method as claimed in claim 9, wherein the calculating the cumulative distribution function further comprises re-establishing the cumulative distribution function based on the following formula:

$$CDF'(K) = CDF(K) - \frac{CDF(N-1)}{N-1}K + F(K)$$

wherein  $CDF'(K)$  denotes a compensated cumulative distribution function,  $CDF(K)$  is a cumulative distribution function before compensation,  $F(K)=(\text{the total number of pixels of an image signal}/(N-1))K$ ,  $N-1$  is a maximum pixel value, and  $CDF(N-1)$  is a value of the cumulative distribution function at the maximum pixel value.

11. The adaptive brightness control method as claimed in claim 8, wherein the calculating the function having the predetermined slope comprises:

calculating an average value of the pixel values;

setting a range of the calculated average pixel value; and

calculating a function corresponding to the range of the calculated average pixel value.

12. The adaptive brightness control method as claimed in claim 8, wherein the function is one of a monotonic increasing function, a monotonic decreasing function, and a constant function.

13. The adaptive brightness control method as claimed in claim 8, wherein the pixel value is one among the brightness value, a grayscale value of three primary colors R, G, B and a grayscale value of color difference signals Y, Cb, Cr.